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Engineering Cost Estimating

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Outline

- Motivation for cost estimating
- Introduction and terminology
- General cost estimating methods
 - Conference
 - Comparison
 - Unit

Motivation for Engineering Cost Estimating

- The motivation for professional engineering cost estimating results from the necessity for profits, stewardship of resources, and competition
 - cost estimating requires knowledge of engineering, science, business, and mathematics
 - the initiation of engineering cost analysis arises from design

Cost Estimating v. Accounting

- Accounting
 - deals with cost quantities that have been spent and consistently recorded
- Engineering cost estimating
 - is concerned with cost quantities that have not been spent for a design

Cost Estimating Information

- There are three basic types of cost estimating information:
 - Historical information
 - Measured information
 - Policy information
- Various departments in a typical engineering organization can be used to obtain cost estimating information
 - Accounting, Personnel, Operations, Purchasing
 - Also: Government, Trade Associations

General Elements of Cost

- Direct materials
 - Materials that can be conveniently charged directly to the cost of the product
- Direct labour
 - Can be conveniently and easily charged to the product or service
- Overhead
 - Indirect materials and labour
 - Other

Labour

- Labour comprises one of the most important items of an operation.

$$\text{labour cost} = \text{time} * \text{wage}$$
- Labour estimating and analysis is concerned with direct and not indirect labour

Measured Time

- "Time is a measure of cost"
 - Although debatable, there is an element of truth in this statement when we consider the needs of cost estimating
- In cost estimating, we typically use three sources for time estimates:
 - "guesstimate"
 - historical records
 - tabulated data (from time studies, man-hour reports, work sampling)

Materials



- ◆ The following design documents should be consulted:
 - Engineering bill of materials
 - Specifications
 - Engineering drawings
- ◆ Direct materials are subdivided into:
 - Raw materials
 - Standard commercial materials
 - Subcontracted items

General Estimating Methods

- ◆ Estimating methods are remarkably similar even though designs may differ
- ◆ The preliminary cost estimate is used by engineering and management for various purposes:
 - to commit or stall additional design effort,
 - to appropriate requests for capital equipment, or
 - to cull out uneconomic designs at an early point

Conference Technique

- ◆ A non-quantitative method of estimation that is used to provide a single value or estimate made through experience
- ◆ Involves members of your design group conferring in a round-table fashion and jointly estimating cost as a lump sum
 - "hidden-card" technique is effective
- ◆ Drawback:
 - lack of analysis and verifiable facts

Comparison Technique

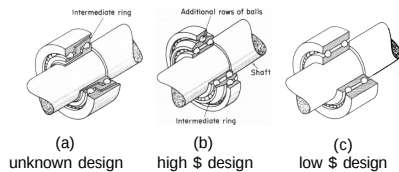
- ◆ When confronted with a difficult design and estimating problem,
 - designate it problem a
 - then construct a simpler design problem for which an estimate can be found (we designate this problem b).

$$C_a(D_a) \approx C_b(D_b)$$

$C_{a,b}$ = value of the estimate for designs a and b

$D_{a,b}$ = design a and design b

E.g.: Comparison Technique



$$C_c(D_c) \approx C_a(D_a) \approx C_b(D_b)$$

Unit Technique

- Examples of unit estimates are found in all activities: e.g.,
 - Cost of house construction per square foot of liveable space,
 - Cost of metal casting per pound, ...
- Assumption: design to be estimated is like the composition of the parameter used to determine the estimate

Unit Technique ...

- A unit estimate is defined as the mean, where the divisor is the principal cost driver

$$C_a = \sum C_i / \sum n_i$$

C_a = average cost per unit of design
 C_i = value of design i in dollars
 n_i = design i unit (lb, in., kg, mm, ...)

E.g.: Unit Technique

Design Weight (lb)	Cost (\$)
2	2
3	3
4	6
9	11

- The cost per pound is \$1.22 (= 11/9).
- A new casting design is estimated by finding the sphere weight and multiplying this value by \$1.22/lb